CLAIMS

Claim 1 (Previously Presented) A computer aided design system comprising:

a point sequence information extraction device which extracts a plurality of point sequences on a curved surface;

a dividing device which generates a curved surface from the point sequences using another computer aided design system, and divides the curved surface into a mesh having a predetermined number of mesh points;

a first fundamental form computing device for computing coefficients of a first fundamental form at a mesh point of the mesh, the coefficients of the first fundamental form being defined at the mesh point by first-order differential values of the mesh point;

a second fundamental form computing device for computing coefficients of a second fundamental form at the mesh point, the coefficients of the second fundamental form being defined at the mesh point by a product of second-order differential values of the mesh point and a normal vector of the mesh at the mesh point; and

a memory device which stores the point sequence information, the coefficients of the first fundamental form and the coefficients of the second fundamental form.

Claim 2 (Previously Presented) The computer aided design system according to claim 1, further comprising:

a principal curvature computing device which computes a principal curvature of the mesh point based on the coefficients of the first fundamental form and the coefficients of the second fundamental form;

a line of curvature computing device which computes a line of curvature showing a principal direction of the mesh based on the principal curvature;

a feature point/feature line analyzing device which extracts a point or a line which becomes a reference point or a reference line, respectively, of a transformation defined by changing patterns of one or more feature quantities among five feature quantities showing features of the curved surface, the five feature quantities comprising a Gaussian curvature and a mean curvature computed based on the principal curvature, the principal direction, the line of curvature, and the coefficients of the first fundamental form and the coefficients of the second fundamental form; and

a girth length computing device which computes a girth length based on a curvature computed from the coefficients of the first fundamental form and the coefficients of the second fundamental form.

Claim 3 (Previously Presented) The computer aided design system according to claim 2, further comprising:

a reproducing device which transforms the line of curvature for the girth length in the line of curvature direction, with the point or the line as the transformation reference point or reference line, respectively, and reproduces a shape of the mesh or the curved surface.

Claim 4 (Previously Presented) The computer aided design system according to claim 3, further comprising:

a converting device which extracts a plurality of point sequences on a curved surface from the reproduced shape of the mesh or the curved surface, and converts the point sequences according to a graphical representation algorithm in another computer aided design system.

Claim 5 (Previously Presented) A computer aided design program stored in a computer-readable recording medium for causing a computer to execute:

a point sequence information extraction process for extracting a plurality of point sequences on a curved surface;

a dividing process for generating a curved surface from the point sequences using another computer aided design program, and dividing the curved surface into a mesh having a predetermined number of mesh points;

a first fundamental form computing process for computing coefficients of a first fundamental form at a mesh point of the mesh, the coefficients of the first fundamental form being defined at the mesh point by first-order differential values of the mesh point;

a second fundamental form computing process for computing coefficients of a second fundamental form at the mesh point, the coefficients of the second fundamental form being defined at the mesh point by a product of second-order differential values of the mesh point and a normal vector of the mesh at the mesh point; and

a storage process for storing the point sequence information, the coefficients of the first fundamental form and the coefficients of the second fundamental form.

Claim 6 (Previously Presented) The computer aided design program stored in a computer-readable recording medium according to claim 5, for further causing a computer to execute:

a principal curvature computing process for computing a principal curvature of the mesh based on the coefficients of the first fundamental form and the coefficients of the second fundamental form;

a line of curvature computing process for computing a line of curvature showing a principal direction of the mesh based on the principal curvature;

a feature point/feature line analyzing process for extracting a point or a line which becomes a reference point or a reference line, respectively, of a transformation defined by changing patterns of one or more feature quantities among five feature quantities showing features of the curved surface, the five feature quantities comprising a Gaussian curvature and a mean curvature computed based on the principal curvature, the principal direction, the line of curvature, and the coefficients of the first fundamental form and coefficients of the second fundamental form; and

a girth length computing process for computing a girth length based on a curvature computed from the coefficients of the first fundamental form and the coefficients of the second fundamental form.

Claim 7 (Previously Presented) The computer aided design program stored in a computer-readable recording medium according to claim 6, for further causing a computer to execute

a reproducing process for transforming the line of curvature for the girth length in the line of curvature direction, with the point or the line as the transformation reference point or reference line, respectively, and reproducing a shape of the mesh or the curved surface.

Claim 8 (Previously Presented) The computer aided design program stored in a computer-readable recording medium according to claim 7, for further causing a computer to execute

a converting process for extracting a plurality of point sequences on a curved surface from the reproduced shape of the mesh or the curved surface, and converting the point sequences according to a graphical representation algorithm in another computer aided design system.

Claim 9 (Previously Presented) A computer graphics system comprising:

a point sequence information extraction device which extracts a plurality of point sequences on a curved surface;

a dividing device which generates a curved surface from the point sequences using another computer graphics system, and divides the curved surface into a mesh having a predetermined number of mesh points;

a first fundamental form computing device for computing coefficients of a first fundamental form at a mesh point of the mesh, the coefficients of the first fundamental form being defined at the mesh point by first-order differential values of the mesh point;

a second fundamental form computing device for computing coefficients of a second fundamental form at the mesh point, the coefficients of the second fundamental form being defined at the mesh point by a product of second-order differential values of the mesh point and a normal vector of the mesh at the mesh point; and

a memory device which stores the point sequence information, the coefficients of the first fundamental form and the coefficients of the second fundamental form.

Claim 10 (Previously Presented) A computer graphics program stored in a computer-readable recording medium for causing a computer to execute:

a point sequence information extraction process for extracting a plurality of point sequences on a curved surface;

a dividing process for generating a curved surface from the point sequences using another computer graphics program, and dividing the curved surface into a mesh having a predetermined number of mesh points;

a first fundamental form computing process for computing coefficients of a first fundamental form at a mesh point of the mesh, the coefficients of the first fundamental form being defined at the mesh point by first-order differential values of the mesh point;

a second fundamental form computing process for computing coefficients of a second fundamental form at the mesh point, the coefficients of the second fundamental form being defined at the mesh point by a product of second-order differential values of the mesh point and a normal vector of the mesh at the mesh point; and

a storage process for storing the point sequence information, the coefficients of the first fundamental form and the coefficients of the second fundamental form.

Claim 11 (Previously Presented) The computer aided design system according to claim 1,

wherein, in a case where a mesh point of the mesh is represented by S(u, v), the coefficients of the first fundamental form at the mesh point represented by S(u, v) are E, F and G, such that the coefficients E, F and G are represented by the followings equations:

$$E = Su^2;$$

$$F = Su \times Sv; \text{ and}$$

$G = Sv^2$, and

wherein $Su = \partial s/\partial u$ and $Sv = \partial s/\partial v$.

Claim 12 (Previously Presented) The computer aided design system according to claim 11, wherein the coefficients of the second fundamental form at a mesh point of the mesh are represented by L, M and N, such that L, M and N are represented by the following equations:

$L = n \times Suu$;

$M = n \times Suv$; and

$N = n \times Svv$,

wherein n denotes a normal vector of the mesh at the mesh point where the coefficients of the second fundamental form are represented by L, M and N, and

wherein $Suu = (\partial^2 s/\partial u^2)$, $Suv = (\partial s/\partial v) \times (\partial s/\partial u)$, and $Svv = (\partial^2 s/\partial v^2)$.

Claim 13 (Previously Presented) The computer aided design program according to claim 5, wherein, in a case where a mesh point of the mesh is represented by S(u, v), the coefficients of the first fundamental form at the mesh point represented by S(u, v) are E, F and G, such that the coefficients E, F and G are represented by the followings equations:

$E = Su^2$;

$F = Su \times Sv$; and

$G = Sv^2$, and

wherein $Su = \partial s/\partial u$ and $Sv = \partial s/\partial v$.

Claim 14 (Previously Presented) The computer aided design program according to claim 13,

wherein the coefficients of the second fundamental form at a mesh point of the mesh are represented by L, M and N, such that L, M and N are represented by the following equations:

$L = n \times Suu;$

$M = n \times Suv;$ and

$N = n \times Svv,$

wherein n denotes a normal vector of the mesh at the mesh point where the coefficients of the second fundamental form are represented by L, M and N, and

wherein $Suu = (\partial^2 s/\partial u^2)$, $Suv = (\partial s/\partial v) \times (\partial s/\partial u)$, and $Svv = (\partial^2 s/\partial v^2)$.

Claim 15 (Previously Presented) The computer graphics system according to claim 9,

wherein, in a case where a mesh point of the mesh is represented by S(u, v), the coefficients of the first fundamental form at the mesh point represented by S(u, v) are E, F and G, such that the coefficients E, F and G are represented by the followings equations:

$E = Su^2;$

$F = Su \times Sv;$ and

$G = Sv^2,$ and

wherein $Su = \partial s/\partial u$ and $Sv = \partial s/\partial v$.

Claim 16 (Previously Presented) The computer graphics system according to claim 15,

wherein the coefficients of the second fundamental form at a mesh point of the mesh are represented by L, M and N, such that L, M and N are represented by the following equations:

$L = n \times Suu;$

$M = n \times Suv;$ and

$N = n \times Svv$,

wherein n denotes a normal vector of the mesh at the mesh point where the coefficients of the second fundamental form are represented by L, M and N, and

wherein $Suu = (\partial^2 s/\partial u^2)$, $Suv = (\partial s/\partial v) \times (\partial s/\partial u)$, and $Svv = (\partial^2 s/\partial v^2)$.

Claim 17 (Previously Presented) The computer graphics program according to claim 10,

wherein, in a case where a mesh point of the mesh is represented by S(u, v), the coefficients of the first fundamental form at the mesh point represented by S(u, v) are E, F and G, such that the coefficients E, F and G are represented by the followings equations:

$E = Su^2$;

$F = Su \times Sv$; and

$G = Sv^2$, and

wherein $Su = \partial s/\partial u$ and $Sv = \partial s/\partial v$.

Claim 18 (Previously Presented) The computer graphics program according to claim 17,

wherein the coefficients of the second fundamental form at a mesh point of the mesh are represented by L, M and N, such that L, M and N are represented by the following equations:

$L = n \times Suu$;

$M = n \times Suv$; and

$N = n \times Svv$,

wherein n denotes a normal vector of the mesh at the mesh point where the coefficients of the second fundamental form are represented by L, M and N, and

wherein $Suu = (\partial^2 s/\partial u^2)$, $Suv = (\partial s/\partial v) \times (\partial s/\partial u)$, and $Svv = (\partial^2 s/\partial v^2)$.